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Cleaning of Free Machining Brass

T. Shen

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Cleaning of Free Machining Brass

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By Tien Shen

SUMMARY

We have investigated four brightening treatments proposed by two cleaning vendors for cleaning free machining brass. The experimental results showed that none of the proposed brightening treatments passed the swipe test. Thus, we maintain the recommendation of not using the brightening process in the cleaning of free machining brass for NIF application.

INTRODUCTION

NIF's cleaning procedure¹ prohibits the use of chemical brightener, such as Macro-Brite™, to clean free machining brass. The brightening agent forms a chemical compound on brass surfaces and provides tarnishing resistance. For most grades of brass alloys, the brightening treatment does not pose a cleanliness problem. However, in the case of free machining brass, the brightening compound didn't stick to the surface firmly due to the addition of lead, and could be easily wiped off during swipe test and failed the NIF cleanliness standard². This finding led to the recommendation of not using a brightening treatment in the cleaning of free machining brass parts for NIF applications. Unsurprisingly, the free machining brass parts without the brightening treatment tarnish overtime and create some concern in the acceptance of these parts as "gross-cleaned" from cleaning vendors.

To address the concern of tarnishing of free machining brass, cleaning vendors have suggested that other chemical brightening processes may form a more adherent compound on brass surfaces thus alleviating the cleanliness problem. This study was initiated to evaluate chemical brightening processes proposed by two cleaning vendors, i.e. TMPI in Hayward, CA and Hytek in Kent, WA. This memo documents the results of the brass cleaning experiments conducted at these two companies.

TESTING MATERIAL

Two brass alloys C260 and C360 (free machining grade) were used in this investigation. The 12" x 12" test panels were machined to a 32M finishing using NIF approved Hengsterfer's S506-CF cutting fluid. The nominal compositions of these two alloys are as follows:

¹ The MEL 99-009-OH Procedure G-VII, "Chemical Cleaning of Copper and Copper Alloy Components"

² NIF 0091836, "Cleaning of Brass", Tien Shen, Dec. 13, 2002.

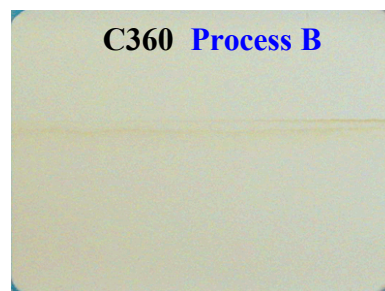
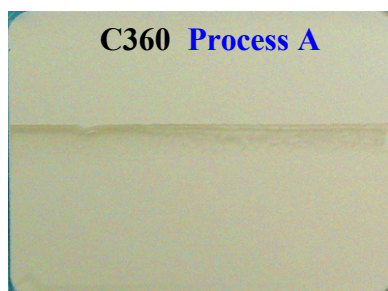
Alloy	Zn (wt%)	Pb (wt%)	Cu(wt%)
C260	35	-	65
C360	35.5	3.0	61.5

TMPI Experiment

The experiment was conducted at TMPI on 9/16/05. The cleaning process involved an alkaline cleaning followed by a brightening treatment to prevent brass from tarnishing. TMPI proposed two brightening treatments using 100% COR 12 (Copper Bright) and HCl acid as described in **Processes A & B**, respectively. NVR and particle swipes were taken at each step of the process. The cleaning conditions on alloys C260 and C360 and the results of NVR/particle swipe are summarized as follows:

	Process A		Process B	
Degrease/ Pre- Cleaning	<ul style="list-style-type: none"> • IPA wipe • Enthone Q-527, 50°C/10 min. • Process water spray rinse • D.I. water rinse in Class 100 Room 		<ul style="list-style-type: none"> • IPA wipe • Enthone Q-527, 50°C/10 min. • Process water spray rinse • D.I. water rinse in Class 100 Room 	
	↓		↓	
NVR (mg/in ²) / PS	Alloy C260 0.01 / 60	Alloy C360 - / 57	Alloy C260 0.01 / 77	Alloy C360 0.04 / 65
	↓		↓	
Brightening	<ul style="list-style-type: none"> • COR-12, (100%), R.T / 30 sec. • Process water spray rinse • D.I. water rinse in Class 100 Room 		<ul style="list-style-type: none"> • HCl (37 wt%) diluted to 50 vol %, for 3 min. • Process water spray rinse • D.I. water rinse in Class 100 Room 	
	↓		↓	
NVR (mg/in ²) / PS	Alloy C260 0.01 / 75	Alloy C360 0.00 / 73	Alloy C260 0.02 / 83	Alloy C360 0.04 / 72

This result confirms our previous finding² that the pre-cleaning of brass in alkaline cleaner (Enthone Q-527) is sufficient to remove NVR and particles to an acceptable level of less than 0.1 mg/in² and level 83, respectively. Although the two brightening processes proposed by TMPI passed the NVR/particle swipe criteria, smudges³ appeared on the swipe papers (as shown below) indicating that the brightening compound was wiped off from the surface of C360 alloy.

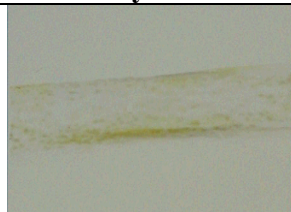

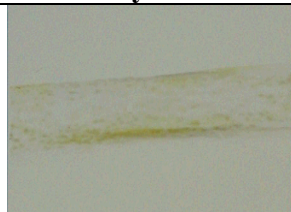


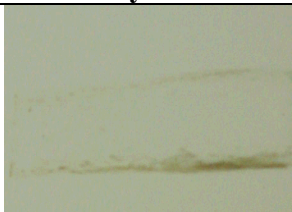

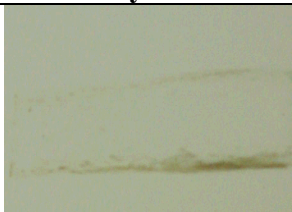
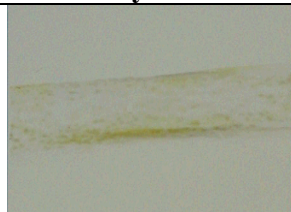


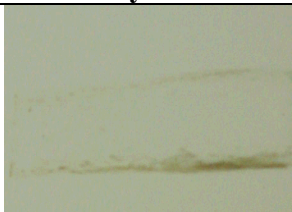

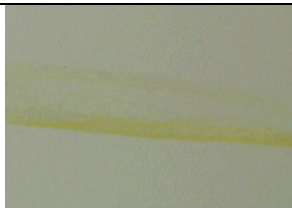

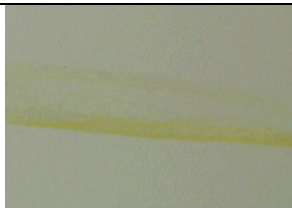
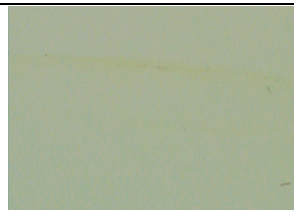
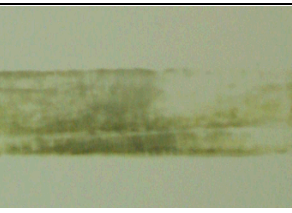
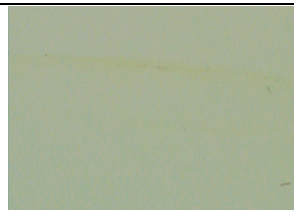
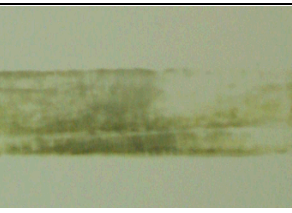

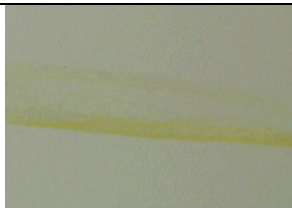
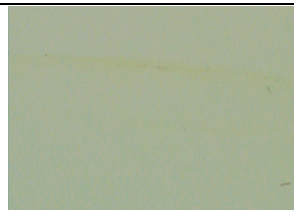
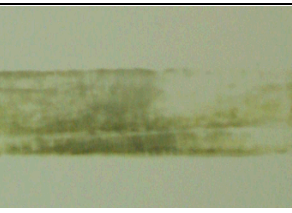


³ The particles in the smudge are often less than 5 mm, thus would not be detected by the PSVS.

Hytek Experiment

The experiment was conducted at Hytek on 11/17/05. The cleaning experiment involved two different cleaners and brightening processes. However, Hytek lacks a Class 100 Clean Room and has no capability to take particle swipe and NVR. Furthermore, the city water was used for rinsing after each cleaning step with no high pressure D.I. water spray available. These inevitability affected the cleanliness result.

With all these compromises, no particle swipe readings and NVR measurements were taken in this experiment. Instead, the cleaning experiment was centered on examining the adhesion of brightening compound on brass surface by swiping the brightening-treated surface with filter paper. The cleaning conditions (**Processes C & D**) on alloys C260 and C360 and the appearance of filter paper swipe after each processing step are summarized as follows:

	Process C		Process D									
Degrease/ Pre- Cleaning	<ul style="list-style-type: none">• IPA wipe• Isoprep 58 @ 79.4°C for 10 min.• City water rinse• D.I. water rinse in clean room		<ul style="list-style-type: none">• IPA wipe• Enthone Q-527 @ 53°C for 10 min.• City water rinse• D.I. water rinse in clean room									
	↓		↓									
Filter Paper Swipe	<table><tr><th>Alloy C260</th><th>Alloy C360</th></tr><tr><td></td><td></td></tr></table>	Alloy C260	Alloy C360				<table><tr><th>Alloy C260</th><th>Alloy C360</th></tr><tr><td></td><td></td></tr></table>	Alloy C260	Alloy C360			
	Alloy C260	Alloy C360										
												
Alloy C260	Alloy C360											
												
	↓		↓									
Brighten- ing Treatment	<ul style="list-style-type: none">• Etch in fluorboric acid (1.25-2.5 oz/gal) @ R.T. for 30 sec• City water rinse• Micro-Brite C-9, (8-16 oz/gal) @ R.T. for 30 sec.• City water rinse• D.I. water rinse in clean room		<ul style="list-style-type: none">• Acid etch in Oakite LNC Deox (15-20% by volume) @ R. T, for 30 sec• City water rinse• D.I. water rinse in clean room									
	↓		↓									
Filter Paper Swipe	<table><tr><td></td><td></td></tr></table>				<table><tr><td></td><td></td></tr></table>							
												
												

These results showed that smudge appeared on swipe paper on all samples after the pre-cleaning. This is contrary to all of our previous findings and suggests that a city water rinse, without the high pressure D.I. water spray, was not capable of removing smut generated

during the pre-cleaning process. After the brightening treatment, the swipe test showed that the brightening compound could be wiped off from the surface of C360 alloy.

CONCLUSIONS

- The cleaning of brass in alkaline cleaner, such as Enthone Q-527, followed by high pressure D.I. water spray is sufficient to remove NVR and particles to acceptable levels of 0.1 mg/in² and level 83, respectively.
- None of the brightening treatments for free machining brass proposed by TMPI and Hytek passed the swipe test. Thus, we maintain the recommendation of not using the brightening process in the cleaning of free machining brass.

Distribution:

Cleanliness Steering Committee members

Brian MacGowan

Kirk Staggs

Raul Rebak

Mike Stone

Kalvin Listiyo

Janet Nielsen (TMPI)

Noad Shapiro (TMPI)

Mark Davidson (Hytek)